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LATHES · FLOTURN MACHINES
PRESS BRAKES · SHEARS
HYDRAULIC PRESSES
FOAM POLYSTYRENE EQUIPMENT
PACKAGING MACHINERY

THE Lodge & Shipley COMPANY

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CABLE ADDRESS "LODGESHIPLEY"

January 14, 1963

Commanding Officer
Picatinny Arsenal
Dover, New Jersey

Attention: Purchasing Officer ORDBB-PB1

Subject: Twenty-third Monthly Progress Report (December 1 through December 31, 1962) on Contract No. DA-33-008-ORD-2084; Magnesium Alloy Airframe; Project No. TN2-8106; OMS Code 5210.11.142; Department of the Army Project No. 512-15-023
OMS Code; 5010.11.14200.19
5010.11.14200.35

Gentlemen:

Upon completion of work on Contract No. DA-33-008-ORD-2332 on Aluminum Alloy Airframe Skins, the new fourth operation arbor was removed from the Floturn Machine and the internal heating rods were installed on December 18th.

Following installation of the rods, the arbor was heated to check operation of the rods and to determine the reaction of the arbor. A preliminary check indicated that there was some distortion of the arbor. On December 19th, the arbor was again brought to operating temperature and a complete check was made of distortion and stability. It was found that the large and small end of the arbor could be maintained at a stable condition with runout held to a maximum of .001 TIR. However, at the middle, the runout was .010.

While the observations were being made to determine the general condition of the arbor at operation temperature, a trace of oil was noticed seeping out between the arbor adapter and the spindle flange. This condition had never been observed prior to this time and since the amount of oil was very slight, no particular signifigance was attached to this matter.

The runout condition existing in the arbor when at operating temperature made it imperative that the arbor be re-machined while hot.

On December 20th, the arbor was again brought to operating temperature and the runout established as .001 T.I.R. maximum at the large and small end. The template was set so that the contoured portion of the arbor could be machined by adjusting the template parallel to center line toward the headstock, thereby permitting stock removal throughout the contour by shortening the arbor slightly without reducing the diameter at the large end.

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A problem was encountered in the break down of the carbide turning tool, however with frequent indexing of the insert and careful blending of cuts in various areas, the machining was carried out until the end of the day at which time approximately one-third of the length of the arbor from the small end had been cleaned-up and the middle third partially cleaned-up but all of the runout not removed. Before shutting down, a check was made of the runout condition of the arbor with the tailstock removed. The large end of the arbor was found to have the same runout of .001 T.I.R. as originally established, however, the small end of the arbor ranout .030 T.I.R. This drastic change was assumed to have resulted from the removal of metal from only a portion of the circumference in the middle third of the length of the arbor. The removal of metal from only a portion of the surface apparently resulted in a differential expansion in the middle of the arbor which caused the small end of the arbor to have a greater runout.

Although it would appear that the additional distortion would present a very serious problem, it was felt that it could be over come by reversing the direction of machining and starting the cuts at the large end finishing the nose last.

On the morning of December 12st, heating power was again applied to the internal heating rods to heat the arbor to operating temperature so that machining could continue. Following standard procedures, the rods were kept under close observation through the hole in the small end of the arbor until it was apparent that they were heating properly. After a period of approximately one hour, it became apparent that the temperature of the arbor was not increasing in a normal manner. Also, the seepage of oil from between the arbor adapter and spindle flange had increased. A visual check of the rods showed that only one of the three heating rods was hot while the other two showed no sign of being at elevated temperature. A check of electrical conditions showed that one fuse in the three phase supply was blown and that an electrical ground existed somewhere inside the arbor.

The arbor was immediately removed from the Floturn Machine, however, the arbor was too hot to permit removal of the adapter for further examination of the rods that day.

On December 26th, the adapter was removed from the arbor and it was found that the alloy sheath of all three rods was burnt through at one end approximately three inches from the end terminal. Also, all surfaces of the arbor, adapter and rods in the cavity at the large end were coated with a brownish white film that is the characteristic result of vaporized oil.

The Local Representative of the heating rod manufacturer was called in to examine the rods and give a preliminary report on the reason for rod failure. The rods were then returned to the manufacturer for further tests to verify the preliminary findings.

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The conditions or chain of events leading up to the failure of the rods can be outlined by reference to the attached composite prints showing the assembly details of arbor as well as the headstock of the Floturn Machine.

Figure A shows the normal installation of the heating rods in the arbor. The position of the end of the rod shown is the designed and actual location the rods in the first, second, third and original fourth operation arbors.

Figure B shows the position of the ends of the heating rods in the new fourth operation arbor. Difficulties encountered with the long, slender core when casting tool steel resulted in the rods extending approximately three inches beyond the correct position. Six slots were milled in the adapter to provide clearance for the rods.

Since the rods were closer to the spindle, a greater heat flow into the spindle was encountered which caused some distortion of the spindle and slinger ring permitting oil to flow out through the bearing knockout holes into the space between the spindle and the arbor adapter. This oil reached the terminal ends of the rods and was absorbed by the Magnesium Oxide insulation in the rods until the oil reached the Nichrome resistor were causing rapid failure of the wire and alloy sheath.

Following the failure of the third set of rods, a complete review of the situation was made and the following determinations made:

(1) The feasibility of forming HK31A Magnesium Alloy by a combination of Floturning and spinning has definitely been proved through the first three operations as outlined in Month Progress Reports #12, 13 and 14, provided the workpiece and tooling are maintained at 700°F as outlined on Page B-28 of Appendix B.

(2) All the problems encountered in the fourth operation were a result of the effect of attempting to maintain a temperature of 700°F in the arbor. While similar problems might have been expected in the earlier operations, the extreme slenderness ratio of the fourth operation arbor compounded the problems.

(3) One attempt was made to solve the tooling problems encountered with elevated temperatures, however, this attempt was unsuccessful.

(4) Further work directed toward the solution of elevated temperature tooling problems is not within the scope of the subject contract.

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(5) Since the feasibility of forming HK31A Magnesium Alloy has been proven under Item (1) above by the application of our best efforts, we believe that all of our obligations under the subject contract have been met and it is our belief that we should not be required to perform additional tooling development work without the necessary adjustment in the fixed fee portion of the contract.

Man hours expended during this report period are as follows; twelve direct engineering production hours; thirty-two direct manufacturing hours; one hour monthly progress report.

Yours very truly,

THE LODGE & SHIPLEY COMPANY

J. A. Warnken

J. A. Warnken, Project Engineer
Metal Forming Division

Wm. H. Busch

Wm. H. Busch, Product Manager
Metal Forming Division

JAW:mas
Enclosures

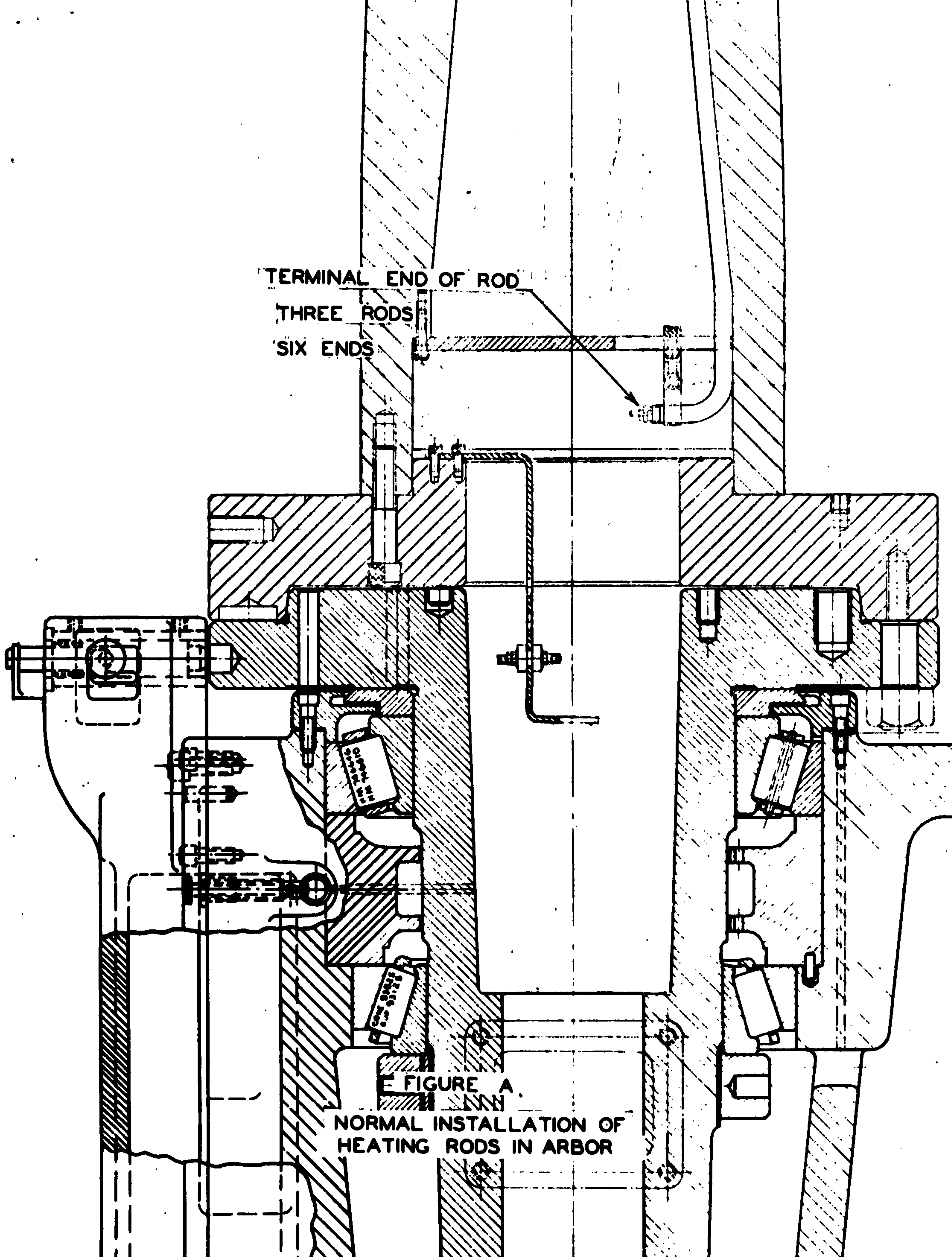

FIGURE A
NORMAL INSTALLATION OF HEATING RODS IN ARBOR

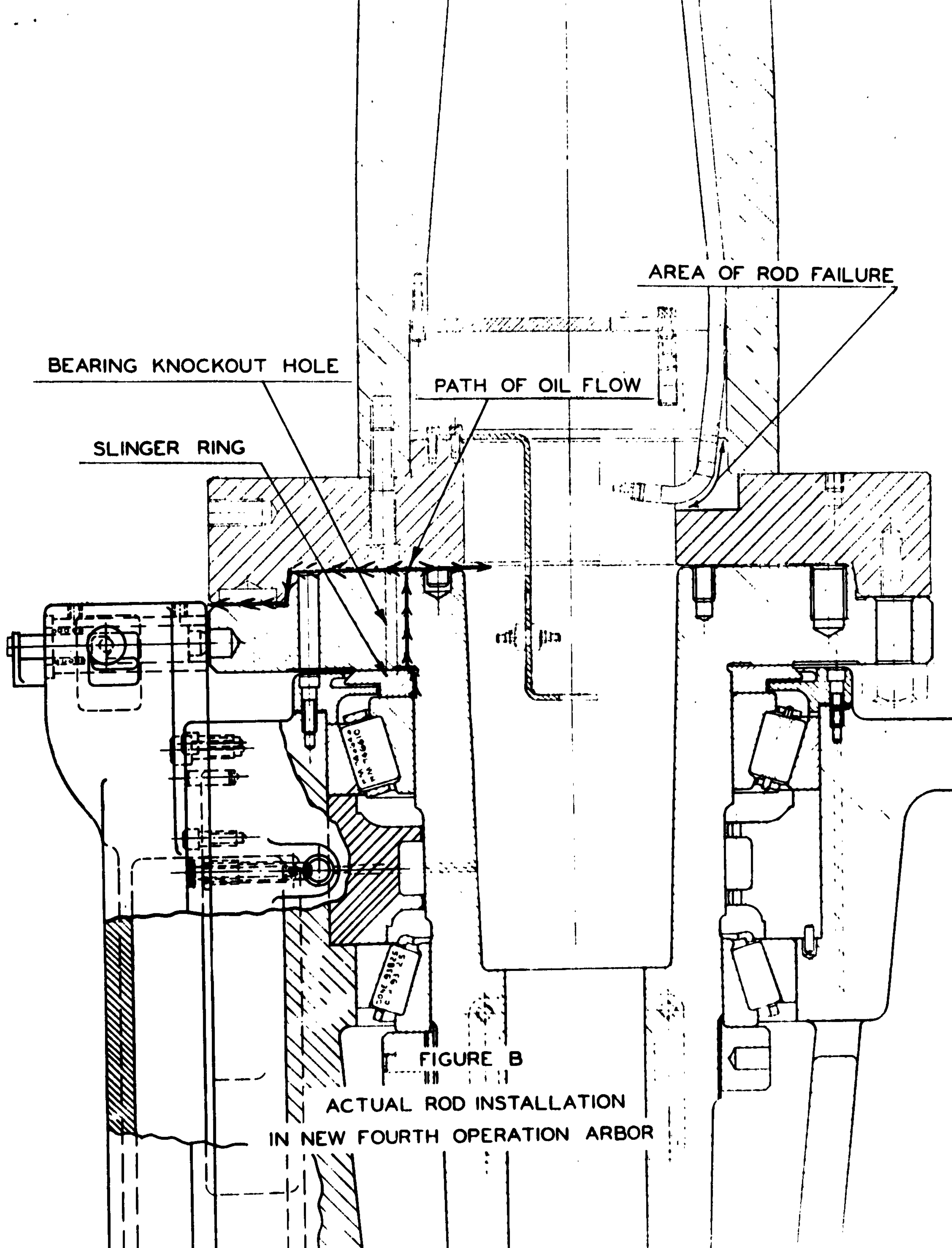

FIGURE B

ACTUAL ROD INSTALLATION
IN NEW FOURTH OPERATION ARBOR